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Small Sizes of Anthracite Coal for Steam Raising

Eckley Brinton Coxe

SMALL SIZES OF ANTHRACITE COAL FOR STEAM RAISING.*

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Eckley Brinton Coxe was born in 1839, graduated from the University of Pennsylvania in 1858, and subsequently studied at the Ecole des Mines and at the Freiberg Mining School. In 1865 Mr. Coxe, in company with his brother, under the firm name of Coxe Bros. & Co., began the business of mining anthracite in the Lehigh region, and since that time has been engaged in the operation of his company's collieries.

THREE years ago I was appointed a member of a commission to investigate the waste of anthracite coal, and the question of the utilization of small sizes was studied with great care by us. The subject was treated generally in a report made to the State of Pennsylvania on May 30, 1893, and also in a paper which I read before the American Institute of Mining Engineers at their August meeting, upon " An Automatic Stoker."

When I first remember the anthracite coal business, all the sizes below stove coal were considered of little or no value. Chestnut coal was used to a greater or less extent about the collieries for making steam, but much of it was thrown away. It gradually became a domestic fuel, and pea coal took its place for generating steam. This size is gradually coming into use for domestic purposes, and buckwheat coal is taking its place for steam. Two smaller sizes, known as rice and barley, are already being used to a large extent for the same purpose. The value or cost of these coals decreases very rapidly with the size. I append herewith a table showing the size and approximate cost at mines, and the sizes of mesh over which or through which they are made.

Size.	Made Through. Inch.	Made Over. Inch.	Approximate Price at Mines.
Chestnut......	1 ½	⅞	$2.75
Pea...........	⅞	$\frac{9}{16}$	1.25
Buckwheat....	$\frac{9}{16}$	⅜	.75
Rice..........	⅜	$\frac{3}{16}$	.25
Barley........	$\frac{3}{16}$	$\frac{3}{32}$	.10

The above meshes are all round punched, and are the standards adopted by Coxe Bros. & Co. at the Cross Creek Collieries.

Another important point to be noted is, that the cost of transportation of the small sizes is less than that of the large. From the mines to tide, pea coal is charged thirty cents, and buckwheat, rice and barley fifty cents less per ton than the domestic sizes.

One great difficulty encountered in the introduction of these smaller sizes was the fact that, as they were of comparatively little value, but little attention was paid to their preparation, and parties who began to use them did not erect furnaces specially constructed for the purpose, but generally burned them in their old plants, sometimes changing the construction of their grate bars a little.

While the size of the domestic coals made by the different companies are practically the same, there has been a great difference in that of the small coals and in the amount of impurities contained in them. Formerly a large amount of culm was employed where it could be obtained cheaply, but its use is diminishing, for the following rea-

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sons: What was formerly known as culm contained the buckwheat, rice, barley, and in some cases the pea coal. Now, however, the pea, buckwheat, rice, and in some cases the barley are taken out, and the dust that remains, which forms what is now called culm, although it may be still used by mixing with bituminous coal, or in a special furnace in which it is burned as dust after being thoroughly pulverized, or by making briquettes or compressed fuel, is at present of no value alone and in its natural state for generating steam.

As is well known to all those who burn anthracite, sizing is of great importance. The coal burns only on the surface, and therefore, if the size is not uniform, the smaller particles clog the passages between the larger, and thereby prevent a sufficient quantity of air from passing through the furnace. Some of those who have attempted to use buckwheat, rice and barley have given them up, because of the great want of uniformity in the results obtained. The difficulty may be due to one of two causes, or both. First, to bad sizing, and second, to the presence of a large quantity of impurities. Experiments which we have made have proved that the percentage of carbon when small anthracites are burned under proper conditions, and not the size, is what determines the amount of water evaporated per pound of coal; but the amount of water evaporated per square foot of heating surface decreases with the size of coal.

Cheap steam is the corner-stone of a large number of our most important industries, and nothing is more important in obtaining it than cheap fuel. The enormous quantity of these small anthracites which we are now forced to make in preparing the larger sizes promises to furnish to the Northeastern and Eastern States a clean and economical fuel, which lends itself to mechanical handling far better than any other known combustible. The only thing that prevents every ton that can be produced from being used is the want of knowledge of its peculiarities and of proper methods of determining its value. In many parts of Europe coal is sold based upon the percentage of ash; that is to say, coal is guaranteed to contain not over a certain percentage of ash, and the price per ton is reduced a certain number of cents per ton for each additional unit of ash, and in some cases the deduction in the price increases in a geometrical and not an arithmetical progression, as the percentage of ash increases. It seems to me that it is of the greatest importance to the producer and user of the smaller anthracites that they should be sold on this basis, with an additional guarantee on the part of the producer as to the size. It is not simply a question of the absolute size of these smaller coals, but also one of the relative size of the different pieces which make up the aggregate; that is to say, each size should be as nearly uniform as possible. If we consider the coal to be made up of three sizes, Nos. 1, 2 and 3, No. 1 being the largest size, a ton of coal composed entirely of No. 2 would be much more valuable than one composed of the three, although the quantity of No. 1 in it might be greater than the quantity of No. 3. The smaller pieces tend to stop up the interstices between the larger lumps, and check the draft. It is one of the problems in burning small coal to force the air through a grate that will not let the coal drop, and through the body of coal which is more or less compact. Of course it is not practically possible to have the size of the coal absolutely uniform, but the producer should at least guarantee that a certain percentage of the coal sold as rice should be of such size that it would pass through a mesh of a specified diameter, and over a mesh of another specified diameter. In other words, with the present light I have upon the subject, if I was in charge of a large steam plant burning, say, 100,000 tons of rice coal per year, I would try to make a contract which would require the coal to contain not over a certain percentage of water and not less than a certain percentage of carbon, or, what is practically the same thing for anthracite, not over a certain percentage of ash, and that a certain percentage of the average daily sample of the coal would pass through a mesh of a certain size and over a mesh of another size, and that the coal should not contain more than a certain percentage of dust —dust being what would pass through a mesh of, say, one-sixteenth of an inch in diameter.